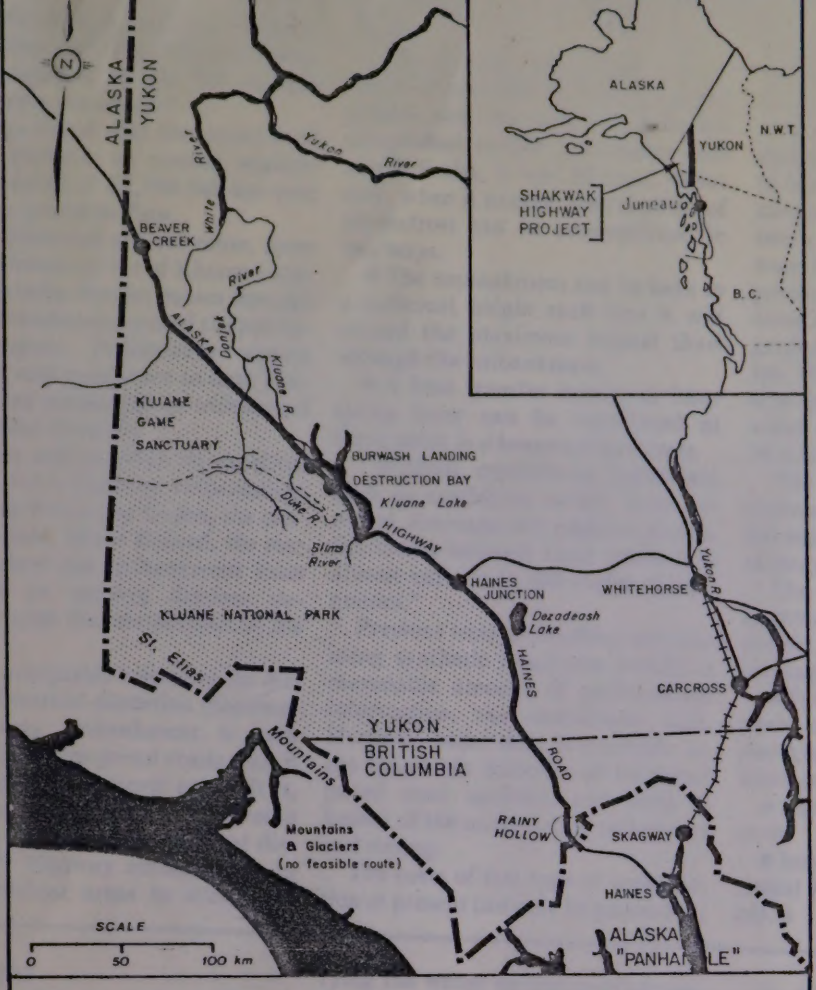


Yukon winters pose problems for $200m. highway

Long and harsh Yukon winters have posed some difficult problems and unusual solutions for the Shakwak Project, the re-alignment, reconstruction and repaving of 520 kilometres of road passing through northwest British Columbia and southwest Yukon along Haines Rd. and the Alaska Highway.

Preliminary cost estimates of $200 million with a construction schedule of 10 years have been discussed for the project which will result in improved access between Juneau, the Alaskan capital and the interior of Alaska as well as improved transportation along this corridor of Canada.

The job is being managed by Public Works Canada with the cost being paid by the United States government. Subsequently Canada will maintain the highway.

Consultants on the project said the physical aspects of the route comprise formidable engineering challenges. The consulting team includes Thurber Consultants Ltd., De Leuw Cather, Canada Ltd., De Leuw Cather Chicago Ltd., plus six additional specialist consultants.

The engineering phase involved a study of alternative corridors and modes along with traffic projections, route selection, geotechnical, permafrost and the need for paving. Route selection, paving versus gravel and permafrost were the most critical issues.

The principal object of the route selection, the consultants said, was that the reconstructed highway fulfill its engineering requirements in such a way as to cause the least impact on the surrounding countryside.

Every effort was made to realign the highway to avoid extensive construction on virgin tracts of land and the proposed alignment achieved this goal, except for two major areas. Due to poor geometrics of the existing road and the steep terrain, the 20 kilometres, immediately north of the Alaska-B.C. border required a major realignment but within the same valley as the existing road. The other realignment involves approximately 11 km adjacent to the Kluane River, where the present road has suffered severe erosion.

Sharing Cost

Overall the route will generally remain close to its present location with minor alignment improvements following the natural terrain to avoid extensive cuts and fills.

With winter in the north generally occurring from October through April, the challenge of maintaining this all weather access will not be easy, the consultants said. Because snow precipitation decreases as one travels northwards, snow is more of a problem in the southern portion of the route.

To minimize snow drifting in the winter the road will be constructed on an embankment at least one metre high with flat side slopes with the right of way cleared of all shrubs for a distance of at least 20 metres. Cleared portions of the right of way can be revegetated with grass. Where grades permit, cut sections have been eliminated in favor of shallow fills over high areas to minimize snow maintenance.

A Shakwak highway environmental impact study concluded that overall highway safety would be enhanced by a reconstructed and paved facility, the consultants indicated.

During the public hearings, it was noted, some corridor residents had expressed their preference for an upgraded gravel road. "Since the American taxpayer is paying for the con-

struction and the Canadian taxpayer the subsequent maintenance, long-term economic effects for maintenance were evaluated."

It was found that the paved road would produce an annual maintenance saving of $2,700 per km over that of a gravel surface.

The Shakwak project route, from the northwest corner of Kluane Lake, to the Alaska border, passes through the discontinuous zones of the permafrost region. Preliminary terrain analysis and experience to date indicated that permafrost is widespread throughout this area.

Frozen soil provides an excellent bearing for a highway embankment as long as it remains frozen, the consultants said. When thawed, the material below the embankment loses strength in varying degrees depending upon the composition of the soil.

"The acceptable tolerance for differential vertical distortion (heaving) of highway embankment is very much smaller for paved roads than it is for unpaved or gravel roads. It is, therefore, imperative to develop methods of limiting the vertical distortion of highway embankment in the permafrost areas to acceptable levels."

The consultants said complete removal of permafrost is the safest approach, and whenever it can be accomplished within reasonable economic limits, it will be used. However, when it cannot, the retention of permafrost can be accomplished in two ways.

- The embankment can be built to a sufficient height such that it will exceed the maximum annual thaw through the embankment.
- A heat transfer barrier or insulating layer can be introduced at some point in a lower embankment.

"Without considering arguments such as aesthetics, safety, snow removal, drainage and adjacent access, the choice between these methods is almost entirely in the realm of economics."

Previous tests on roadway sections using synthetic insulation provide a reasonable amount of performance information, the consultants said. However, scant data is available on the long-term behavior of insulated paved road sections, and little is known of the construction techniques and timing.

The costs of this type of construction at present can only be guessed at, and pilot projects to further study this problem are a consideration, the consultants add.

It was realized from the beginning that the Shakwak project was too big to be handled as a single construction contract and had to be sub-divided into a number of parts. Past experience by DPW on rebuilding major portions of the Alaska Highway indicated that the best length of a major grading contract was about 30 to 40 km. With this in mind and using natural boundaries, the route was divided into 18 segments averaging 28.4 km.

The first two road construction contracts totalling $3.5 million for 55 km adjacent to Haines Junction, have already been awarded.

The United States and Canadian governments believe the Shakwak project will have several benefits including:

- Fulfillment of the need for a paved all-weather link between interior Alaska, southeast Alaska and the lower states.
- Savings in user travel time and costs.
- Improvement in recreation potential for U.S. and Canadian tourists. ■

Thermal now melting

(From page 21)

ared for the city, it was claimed that he method is cheaper than trucking ng distances to snow dumps.

The technique used in a thermal ow melter is "submerged combuson" and is made possible by the use a thermal high velocity oil burner gas burner which is capable of leasing over 10 million BTU per ur per cubic feet of combustion ace.

The burner fires downward, directg the hot gases of combustion rough a stainless steel tube which is mersed below the water level in a or tank. With this arrangement, products of combustion exhaust ectly into the water and rise in the m of millions of bubbles to escape o the atmosphere.

Manufacturers say that this bubng action scrubs all the heat out of gases so that the heat transfer is entially perfect. At the same time, rising gases create an air-lift carrying the water up the annular area formed by a weir tube to the top opening where the warm water overflows as a cascading spray of the snow in the pit or tank.

The water created by the melted snow flows out of the overflow drain to a storm sewer or other drainage facility. The water run off is so rapid that freezing will not occur, even in sub-zero temperatures.

Several types of systems are available.

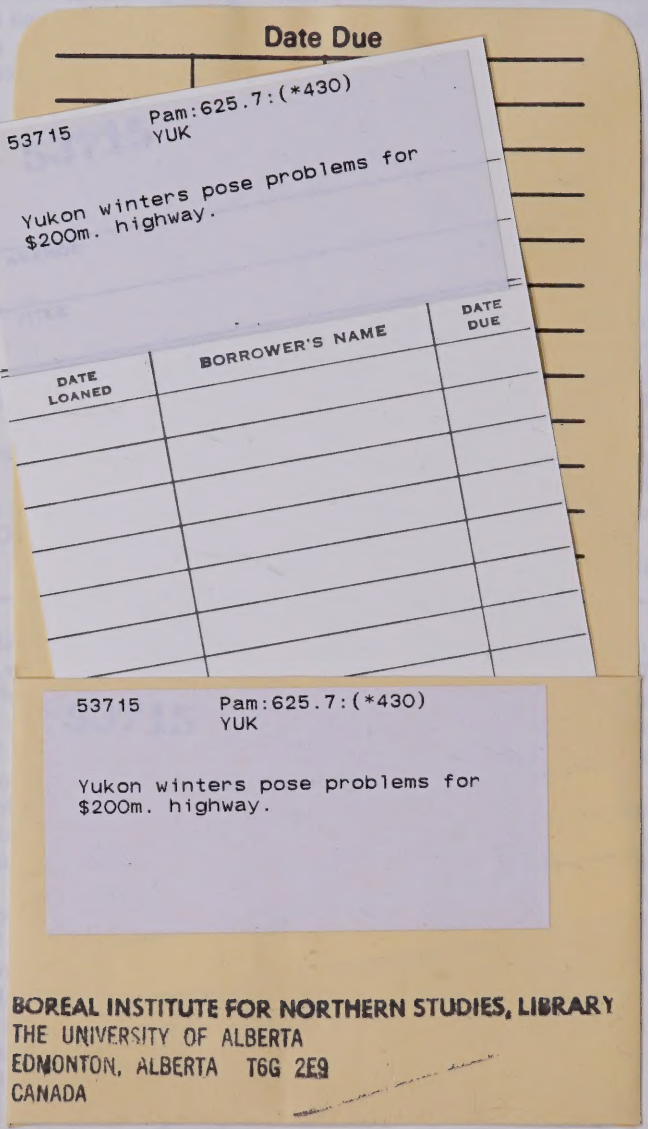
Availability of land and dumping sites are among factors to be considered

In the fully mobile system, the melting tank, burner, controls, fuel tank and auxiliaries are all trailer mounted and can be moved in conjunction with snow loading equipment. These can be front-end loaders, conveyors or snow blowers. The water drain-off occurs through lengths of hose which are played out to the nearest sewer outlet.

However, with good drainage conditions, the water can be released into gutters to wash off streets.

With a semi-mobile arrangement everything except the melting tank is on a trailer and the melting is done in a pit. The same burner can service several melting pits by moving it from one to another as the plowing pattern progresses over a large area.

A completely stationary system is available consisting of a melting pit with the burner permanently mounted. The auxiliary equipment (blower, pump, controls) is usually adjacent, inside a building. Since the pit is entirely beneath grade, the snow can be easily plowed directly into the melting pit. The water produced is allowed to flow out of a side drain to a storm sewer. ■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